ABSTRACT

An objective of the present invention is to provide an autonomous control method that autonomously controls a small unmanned helicopter toward target values, such as a set position and velocity, by deriving model formulas that are well suited for the autonomous control of small unmanned helicopters, by designing an autonomous control algorithm based on the model formulas, and by calculating the autonomous control algorithm.

The autonomous control system for a small unmanned helicopter of the present invention comprises: sensors that detect the current position, the attitude angle, the altitude relative to the ground, and the absolute azimuth of the nose of the aforementioned small unmanned helicopter; a primary computational unit that calculates optimal control reference values for driving the servo motors that move five rudders on the helicopter from target position or velocity values that are set by the ground station and the aforementioned current position and attitude angle of the small unmanned helicopter that are detected by the aforementioned sensors; an autonomous control system equipped with a secondary computational unit that converts the data collected by said sensors and the computational results as numeric values that are output by said primary computational unit into pulse signals that can be accepted by the servo motors, such that these components are assembled into a small frame box, thereby achieving both size and weight reductions;

a ground station host computer that can also be used as the aforementioned computational unit for the aforementioned autonomous control system;

if the aforementioned ground station host computer is used as the aforementioned computational unit for the aforementioned autonomous control system,

in the process of directing the computational results that are output from said ground station host computer to said servo motors through a manual operation transmitter, a radio control generator that converts said computational results as numerical values into pulse signals that said manual operation transmitter can accept;

a servo pulse mixing/switching apparatus, on all said servo motors for said small unmanned helicopter, that permits the switching of manual operation signals and said control signals that are output from said autonomous control system or mixing thereof in any ratio;

an autonomous control algorithm wherein the mathematical model for transfer function representation encompassing pitching operation input through pitch axis attitude angles in the tri-axis orientation control for said small unmanned helicopter is defined as

$$G_\theta(s) = e^{-Ls} \frac{K_\theta \omega_{ns}^2}{(s^2 + 2\varsigma_s \omega_s s + \omega_{ns}^2)(T_\theta s + 1)s}$$

such that the aforementioned small unmanned helicopter is controlled autonomously based on the aforementioned mathematical model;